Small Business Innovation Research/Small Business Tech Transfer

Aero-Effected Distributed Adaptive Control of Flexible Aircraft Using Active Bleed, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

The proposed research focuses on the development of a new adaptive control methodology for active control of wing aerodynamic shape to effect distributed aerodynamic forces and moments for maneuvering and stabilization of flexible airframes without moving control surfaces. The new aero-effected flight control will be achieved using output feedback adaptive control of distributed bleed across aerodynamic surfaces, and is particularly suited for high-altitude long endurance vehicles. The large-area air bleed is driven by the inherent pressure differences in flight across the pressure and suction wing surface, and is regulated by low-power, surface-integrated louver valves. Our previous basic research in adaptive control has stressed the ability to model and cancel the effect of uncertainty in output regulation. We also have developed methods for adaptation in the presence of nonlinear actuation, which includes such effects as actuator saturation. These tools are currently being employed in the study of active flow control using synthetic jet actuation, and will be adapted to the problems that are unique to improving aeroelastic performance and active damping of airframe-propulsion-structure interactions using distributed bleed. Phase I will focus on advancing the state of the art in output feedback adaptive control, and demonstration of the capability of aero-bleed to control the dynamic modes of a flexible lifting surface. These efforts will be integrated in Phase-II by using an adaptive controller to regulate a flexible wing flown in three degrees of freedom in a wind tunnel experiment, using an existing traverse mechanism. Another option is to use Atair Aerospace's LEAPP vehicle to flight test a highly flexible wing design. Additional Phase-II and Phase-III transition possibilities include coordinated research efforts with Boeing related to the DARPA Vulture vehicle, and/or with AeroVironment related to the Global Observer vehicle.

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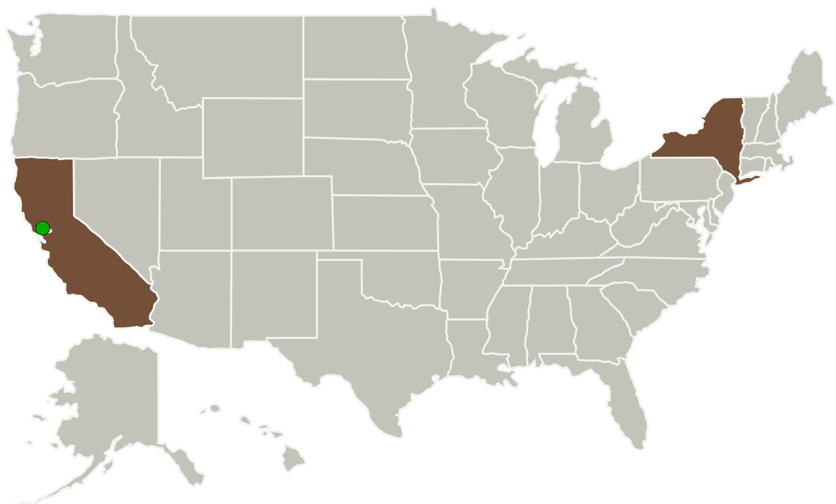
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Atair Aerospace, Inc	Lead Organization	Industry	Brooklyn, New York
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	New York

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137977)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Atair Aerospace, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

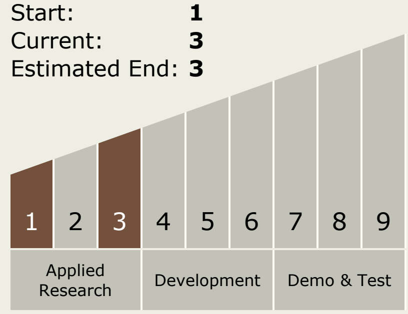
Carlos Torrez

Principal Investigator:

Anthony Calise

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  └ TX15.1 Aerosciences
    └ TX15.1.3 Aeroelasticity

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System